

February 28, 1936

STANDARD THREAD FOR TRIPODS OF SURVEYING INSTRUMENTS

In 1927 a manufacturers' subcommittee working with the Division of Simplified Practice of the National Bureau of Standards prepared a specification for a tripod thread having a nominal diameter of 3 1/2 inches, 8 threads per inch. This thread was considered suitable for use with transits having horizontal limbs 4 1/2 inches or more in diameter at the edge of graduation, and also for all engineers' levels. It was considered for adoption as a commercial standard, but as the makers of surveying instruments did not agree to adopt this thread as a commercial standard either at the conference, or later, it does not have this official status at the present time.

This circular has been prepared to answer requests for detailed information in regard to this thread.

Seven manufacturers of surveying instruments have authorized the Bureau to state that they have accepted this as their standard thread and six additional manufacturers state that they are supplying it on request.

The manufacturers who have adopted this standard for regular production are:

C. L. Berger & Sons, Inc., 37 Williams St., Boston, Mass.

Eugene Dietzgen Co., 954 Fullerton Ave., Chicago, Ill.

W. & L. E. Gurley, Troy, N. Y.

Heller & Brightly, Inc., Columbia Ave. and Hancock St.,
Philadelphia, Pa.

Leupold, Volpel & Co., 425 N.E. 70th Ave., Portland, Oreg.

Warren Knight Co., 136 North 12th St., Philadelphia, Pa.

David White Co., Inc., 315 West Court St., Milwaukee, Wis.

Those who are supplying it upon request are:

Brandis & Sons, Inc., 754-770 Lexington Ave., Brooklyn, N.Y.

Buff & Buff Instrument Co., Jamaica Plain Station, Boston,
Mass.

B. K. Elliott Company, 126 Sixth St., Pittsburgh, Pa.
(on new instruments which they make up to order)

Geier & Bluhm, Inc., Troy, N.Y. (not making surveying
instruments at the present time, Oct. 29, 1935)

Keuffel & Esser Co., Adams and Third Sts., Hoboken, N.J.

Kolesch & Co., 138 Fulton St., New York, N. Y.

The addresses given above are those of the main offices;
Many of the firms have branch offices and representatives in
the larger cities.

Other firms may be prepared to furnish this thread. If
any such names are not on this list, it is because the Bureau
has not been so informed with permission to publish the fact.

The thread has been accepted as standard by various
Government agencies and has been incorporated in specifications
for surveying instruments. It is the standard thread for
transits and levels in the War Department, the Hydrographic
Office of the Navy Department, the United States Geological
Survey, and certain other branches of the Federal Government.

In view of the extensive use of this thread, it is the
logical thread to specify where interchangeability of instru-
ments and tripods is essential, especially in cases of quan-
tity purchase for storage, issue, and use, as, for example,
in the Federal Government purchases, and it is recommended
for this purpose.

Adoption of this standard by the Federal Government,
for use in Government purchase specifications, should not
be interpreted as a requirement or recommendation that it
be adopted by manufacturers for use on their regular line of
instruments. Whether or not it should be so adopted by manu-
facturers is a matter properly left to the manufacturers
themselves.

In considering the advantages of standardization as applied
to the base plate and tripod thread it should be kept in mind
that the object sought is complete interchangeability, to the
end that the base plate of any standard instrument will assemble
with, and fit satisfactorily, any standard tripod head, regard-
less of manufacturer. This interchangeability can be obtained
only by the use of adequate dimensional specifications for the
threads, and an adequate gaging system to insure that the speci-
fied dimensions are actually obtained.

Use of the dimensions and tolerances shown on drawing
Dwg. No. B-1180, issued by the National Bureau of Standards in
1927, insures complete interchangeability.

In putting these dimensions and tolerances into effect it should be kept in mind that the character of "fit between" mating screw threads depends upon the following elements: diameter (i.e. major, minor, and pitch diameter), pitch, angle of thread, and character of thread surface. While all of these elements are important, the relative pitch diameters are of greatest importance in determining the tightness or looseness of the fit of the mating parts. Obviously, if the pitch diameter of any base plate is less than the pitch diameter of any tripod thread these two parts will not assemble. To guard against such a possibility, and to provide for a certain minimum looseness, or maximum tightness, of fit, there is provided a definite allowance between the smallest permissible base plate thread and the largest permissible tripod thread.

A study of drawing Dwg. No. B-1180, shows that if the dimensional limits there given are not exceeded there will always be a clearance on pitch diameter, between base plate and tripod head, of at least 0.0034 inch, and there will never be a looseness greater than 0.0122 inch, on pitch diameter. These limiting values will be obtained by mating the smallest base plate with the largest tripod screw, and the largest base plate with the smallest tripod screw. In general, the looseness will be between these two limiting values.

P.D. of smallest base plate 3.4188"

" " largest tripod screw 3.4154"

" Tightest condition 0.0034"

P.D. of largest base plate 3.4232"

" " smallest tripod screw 3.4110"

Loosest condition 0.0122"

Since the basic thread depth of an 8-pitch thread is 0.0812" it is seen that the depth of thread engagement, even under the loosest condition permitted, is ample for safety: (62% of full thread depth).

In some correspondence between a manufacturer and the Bureau it was suggested by the manufacturer that if a manufacturer worked to the high limit on the tripod thread, and he or some other manufacturer worked to the low limit on the base plate, the two parts would not assemble. A study of Dwg. No. B-1180 shows, as already pointed out, that such is not the case. The parts will always assemble, and will never be excessively loose if the prescribed limits are adhered to.

" The maintenance of the thread dimensions within the specified limits, and accordingly, complete interchangeability without excessive looseness, are insured by the use of correct

"go" and "not go" thread gages. To establish a uniform gaging practice, it is recommended that inspection gages be used which conform to the specifications below. These are based on the American Gage Design Standards, namely, U. S. Department of Commerce Commercial Standard CS8-33, "Gage Blanks," (for blank dimensions, see Tables 12 and 16 and Figure 2) and the National Screw Thread Specifications for Class X gages. (See 1933 Report of the National Screw Thread Commission, National Bureau of Standards Miscellaneous Publication No. 141, pages 52 to 56, and especially Table 18 on page 56.)

Gages for Base Plate Thread

	"Go" thread plug gage	"Not go" thread plug gage ⁽¹⁾
Major diameter, max.	3.5007"	3.4736"
min.	3.5000	3.4729
Pitch diameter, max.	3.4192	3.4232
min.	3.4188	3.4228
Tolerance on half-angle of thread	$\pm 0^{\circ} 5'$	$\pm 0^{\circ} 5'$
Tolerance on lead	$\pm 0.0004''$	$\pm 0.0004''$

- (1) It will be noted that the "not go" thread plug gage is truncated on major diameter below the corresponding dimension of the "go" plug gage. This is to insure non-interference of the "not go" gage at major diameter.

Gages for Tripod Screw Thread

	"Go" adjustable thread ring gage	"Not go" adjustable thread ring or snap gage
Minor diameter, max.	3.3647"	3.3910"
min.	3.3640	3.3917
Tolerance on half-angle of thread	$\pm 0^{\circ} 5'$	$\pm 0^{\circ} 5'$
Tolerance on lead	$\pm 0.0004''$	$\pm 0.0004''$

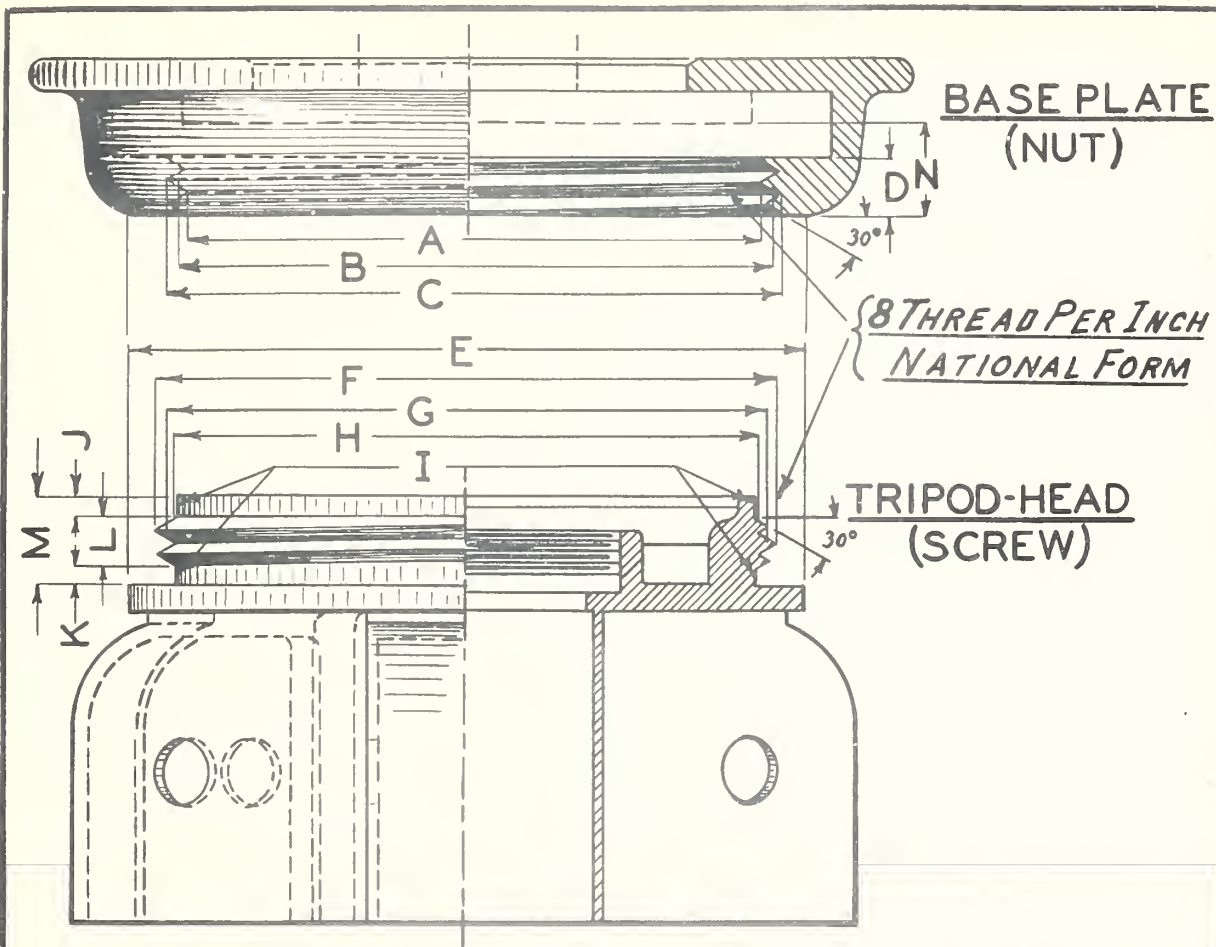
Setting Plugs for Tripod Screw Thread Gages

	"Go" threaded setting plug	"Not go" threaded setting plug
Major diameter, max.	3.4966"	3.4811"
min.	3.4959	3.4804
Pitch diameter, max.	3.4154	3.4114
min.	3.4150	3.4110
Tolerance on half-angle of thread	$\pm 0^{\circ} 5'$	$\pm 0^{\circ} 5'$
Tolerance on lead	$\pm 0.0004"$	$\pm 0.0004"$

The standard temperature for these gages is 68°F.

Base plate and tripod screw threads that pass the above prescribed "go" gages cannot have a clearance on pitch diameter less than 0.0034". Similarly members that do not screw into or on "not go" gages more than one full turn will not have a clearance on pitch diameter in excess of 0.0122" .

Errors in lead or angle in the product reduce the manufacturing tolerance. For instance, a lead error of $\pm 0.00254"$ in the length of engagement on either member will completely consume the manufacturing tolerance of 0.0044" on pitch diameter. In such a case the "go" gage will just screw on or into the member when the pitch diameter is such that the "not go" gage will not enter more than one full turn. The same condition will arise if a lead error of $\pm 0.0013"$ is combined with an error in half-angle of $\pm 0^{\circ} 39'$. It is therefore to the advantage of the manufacturer to hold lead and angle errors as small as possible.



BASE PLATE-NUT		MAX.	MIN.	TRIPOD HEAD SCREW		MAX.	MIN.
Minor Diameter	A	3.3792	3.3647	Diameter of Flange	E		4.0000
Pitch Diameter	B	3.4232	3.4188	Major Diameter	F	3.4966	3.4804
Major Diameter	C	*	3.5000	Pitch Diameter	G	3.4154	3.4110
Length of Thided Part	D		$\frac{13}{32}$	Minor Diameter	H	3.3432	3.3298
				Diam of Lead & Gain	I	3.3298	
				Lead	J	$\frac{1}{8}$	$\frac{3}{32}$
				Gain	K	$\frac{1}{8}$	$\frac{3}{32}$
				Length of Thread	L	$\frac{11}{32}$	$\frac{1}{4}$
				Length of Thided Part	M	$\frac{1}{2}$	$\frac{15}{32}$
				Flange to Shifting Center	N		$\frac{17}{32}$

* CORRESPONDS TO FLAT EQUAL
TO $P \div 24$

** CORRESPONDS TO FLAT EQUAL
TO $P \div 8$

**TENTATIVE STANDARD SPECIFICATIONS
FOR TRIPOD THREAD**

**DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
WASHINGTON D. C.**

DRAWN
Joz 12-13-27

CHECKED
Dr. M. 14-5-27

TRACED
Joz 12-14-27

APPROVED
H. W. S.

DWG. NO. B-1180

**RECOMMENDED BY
MANUFACTURERS
SUB-COMMITTEE**

